

MIL-I-5419B

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SUPERSEDING

MIL-I-5419A

4 October 1950

MILITARY SPECIFICATION**INDICATOR, INDICATED AIRSPEED; PITOT-STATIC, MAXIMUM
ALLOWABLE SPEED, 50-650 KNOTS**

This specification is mandatory for use by all Departments and Agencies of the Department of Defense.

* 1. SCOPE

1.1 Scope - This specification covers a pitot-static, maximum allowable airspeed indicator, range 50-650 knots as listed on MS28048.

2. APPLICABLE DOCUMENTS

2.1 The following documents of the issue in effect on date of invitation for bids or request for proposals, form a part of this specification to the extent specified herein.

* SPECIFICATIONS

Military

MIL-I-5415	Indicators; Airspeed, Pitot-Static Pressure, General Specification for
MIL-P-21563	Paint System, Fluorescent, For Aircraft Application
MIL-L-25142	Luminescent Material; Fluorescent

STANDARDS

Federal

FED-STD-595	Colors
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Military

MIL-STD-781	Reliability Tests Exponential Distribution
MIL-STD-785	Requirements for Reliability Program (for Systems and Equipments)

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STANDARDS

Military (Continued)

MS28048	Indicator, Indicated Airspeed; Pitot-Static, Maximum Allowable Speed, 50-650 Knots
MS33585	Pointer; Dial; Standard Design of Aircraft Instrument

(Copies of specifications, standards, drawings, and publications required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

* 3. REQUIREMENTS

3.1 Qualification - The indicator furnished under this specification shall be a product, samples of which have been tested, which meets the Quality Assurance Provisions specified herein, and has been listed on or approved for listing on the applicable qualified products list.

3.2 General - The requirements specified in MIL-I-5415 are applicable as general requirements of this specification. Where the requirements of MIL-I-5415 and this specification conflict, the requirements of this specification shall govern.

3.3 Material - Material shall be in accordance with the requirements specified in MIL-I-5415.

3.4 Design and construction shall be as specified in MIL-I-5415 and as follows:

3.4.1 Range - The airspeed indicator shall be designed to satisfactorily operate in the range of 50-650 knots.

3.4.2 Dimensions - The airspeed indicator shall conform to the dimensions shown on MS28048.

3.4.3 Pointers - The two pointers shall be concentric, with the maximum speed pointer closest to the dial, and the indicated airspeed pointer nearest the cover glass. The nonindicating end of the pointer shall not obscure the Mach number scale.

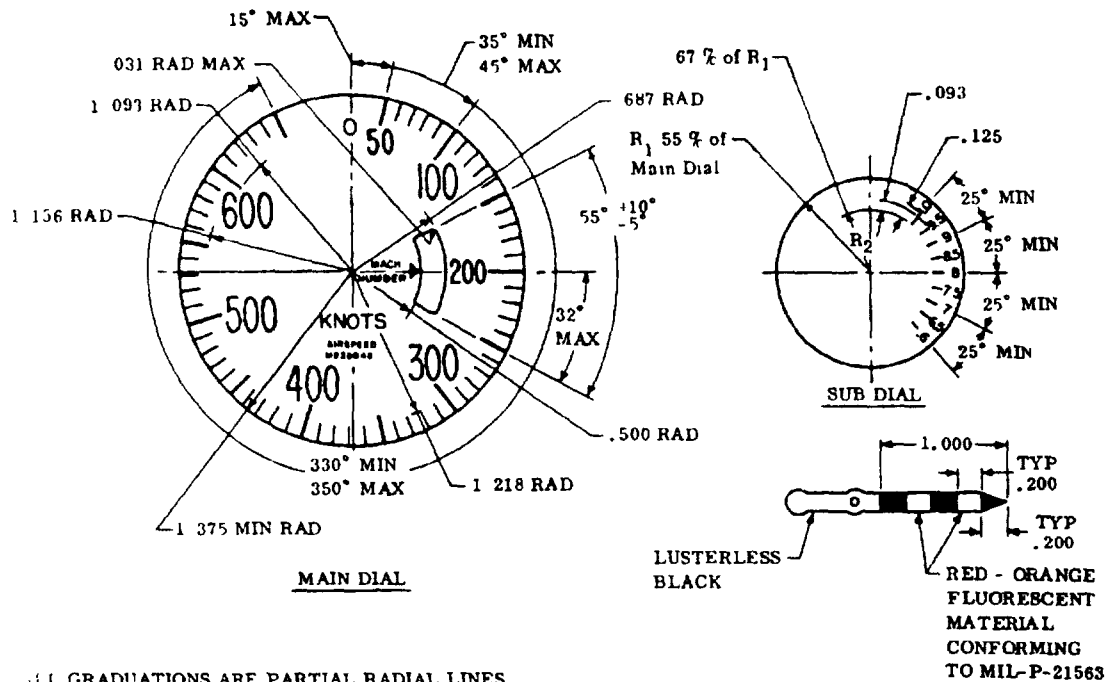
3.4.3.1 Indicated airspeed pointer - The indicated airspeed pointer shall conform to MS33585-3. The shaded portion of the pointer shall be furnished in fluorescent-luminescent material conforming to MIL-L-25142 or lusterless white color No 37875 of FED-STD-595.

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- * 3.4.3.2 Maximum speed pointer - The maximum speed pointer shall be in accordance with MS33585-3 except as shown on Figures 1 or 2.
- 3.4.4 Limitation of pointer movement -
- 3.4.4.1 Airspeed pointer - The airspeed pointer movement shall be limited by suitable stops in the mechanism in such a way that the pointer will not be permitted to rotate more than 350 degrees of arc clockwise from the zero no pressure graduation when the indicator is submitted to overpressure tests. Suitable stops may also be incorporated in the mechanism to limit the counterclockwise rotation of the pointer to the zero graduation. The design of the stops shall be subject to the approval of the procuring activity.
- * 3.4.4.2 Maximum speed pointer - The maximum speed pointer shall be limited by a stop which is adjustable from the front of the indicator by a screwdriver slot in the lower left mounting lug as shown on MS28048. The range of the stop shall be from 300 knots or less to 650 knots. The design of this adjustable stop shall be such that it will in no way affect the indication of the pointer when the altitude and Mach number setting are such that the limiting speed will be lower than that set by the adjustable stop.
- 3.4.5 Mach number adjustment - The adjustment of the Mach number shall be made by removing a pipe plug from the rear of the case and adjusting by use of standard tools. The design of this adjustment shall be subject to the approval of the procuring activity.
- 3.5 Weight - The weight of each indicator shall not exceed 1-1/2 pounds.
- * 3.6 Performance - Airspeed indicators shall satisfy the performance requirements specified in Section 4 of MIL-I-5415, when subjected to the tests headed as follows, except as specified herein:
- | | |
|-------------------------------------|---------------------------------|
| (a) Examination of Product | (i) Pointer Zero Position Error |
| (b) Leakage | (j) Overpressure |
| (c) Scale Error at Room Temperature | (k) Acceleration |
| (d) Friction Error | (l) Humidity |
| (e) Position Error | (m) Salt Spray |
| (f) Damping | (n) Seasoning |
| (g) Weight | (o) Fungus Resistance |
| (h) Magnetic Effect | (p) Aging |
| | (q) Mounting Lugs |

In addition, the indicator shall satisfy the performance requirements specified in Section 4 of this specification when subjected to the tests headed as follows:

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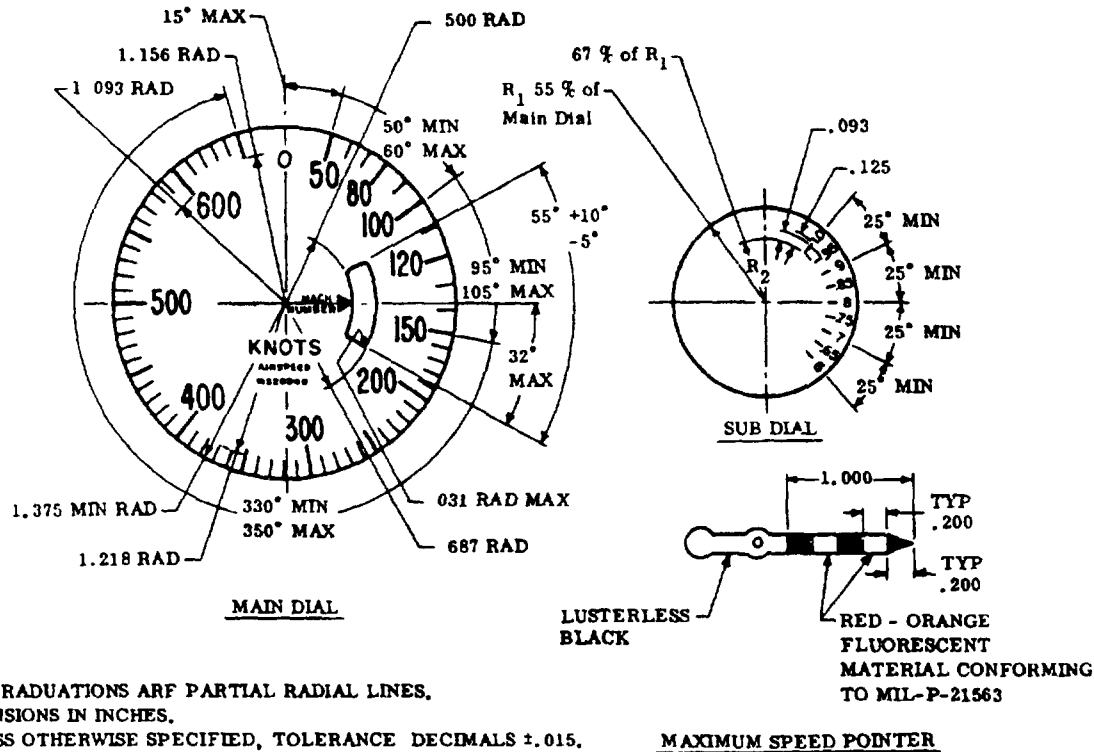
ALL GRADUATIONS ARE PARTIAL RADIAL LINES.
 DIMENSIONS IN INCHES
 UNLESS OTHERWISE SPECIFIED, TOLERANCE DECIMALS ±.015

MAXIMUM SPEED POINTER

MARKING	HEIGHT OR LENGTH (± .010)	WIDTH OF LINE OR GRADUATION (± .005)	MATERIAL OR FINISH
Numerals 100, 300, 400, 500, 600	.250	.031	Fluorescent Luminescent Material per MIL-L-25142 or Lusterless White Color No. 37875 of FED-STD-595
Numerals 200	.187 (min)	.031	
Graduations corresponding to numerals 100, 200, 300, 400, 500, 600	.281 (min)	.031	
Graduations corresponding to 50, 150, 250, 350, 450, 550, 650	.218 (min)	.031	
Knot Readings	As shown on figure	As shown on figure	
Shaded portion of maximum speed pointer	As shown on figure	As shown on figure	
Graduations on Main Dial other than those specified above	As shown on figure	.016	
Numerals 50	.187 (min)	.016	
Numerals 0	.156	.016	
Graduation corresponding to 0	.125	.016	
Lettering "Knots"	.125	.016	Lusterless Black Color No. 37038 of FED-STD-595
Lettering "Mach Number"	.062	.016	
Triangular Mach Number Index	.094	.094	
Numerals on Sub Dial-.6, .7, .8, .9, 1.0	.125	.016	
Numerals on Sub Dial-.65, .75, .85, .95	.093	.016	
Graduations on Sub Dial	As shown on figure	.016	
Lettering "MS28048-1" or "MS28048-3"	.047	.016	
Lettering "Airspeed"	.047	.016	
Background of dials	As shown on figure	As shown on figure	
Unshaded portion of maximum speed pointer	As shown on figure	As shown on figure	

* FIGURE 1 LINEAR DIAL MARKINGS

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MARKING	HEIGHT OR LENGTH $\pm .010$	WIDTH OF LINE OR GRADUATION $\pm .005$	MATERIAL OR FINISH
Numerals 50, 80, 100, 120, 150, 200, 300, 400, 500, 600	.187	.031	Fluorescent Luminescent Material per MIL-L-25142 or Lusterless White Color No 37875 of FED-STD-595
Graduations corresponding to numerals 50, 80, 100, 120, 150, 200, 300, 400, 500, 600	.281 (min)	.031	
Graduations corresponding to 250, 350, 450, 550, 650 Knot Readings	218 (min)	.031	
Graduations on main dial other than those specified above	156 (min)	.016	
Numerals 0	.156	.016	
Graduation corresponding to 0	.125	.016	
Lettering "Knots"	.125	.016	
Lettering "Mach Number"	.062	.016	
Triangular Mach Number Index	.094	.094	
Shaded portion of maximum speed pointer	As shown on figure	As shown on figure	
Numerals on sub dial .6, .7, .8, .9, 1.0	.125	.016	Lusterless Black Color No. 37038 of FED-STD-595
Numerals on sub dial .65, .75, .85, .95	.093	.016	
Graduations on sub dial	As shown on figure	.016	
Lettering "MS28048-2" or "MS28048-4"	.047	.016	Lusterless Black Color No. 37038 of FED-STD-595
Unshaded portion of maximum speed pointer	---	---	
Lettering "Airspeed"	.047	.016	
Background of dials	---	---	

Where practicable all numerals shall be so arranged that the center of mass of the numerals is on the radial line joining the appropriate graduation and the center of dial.

* FIGURE 2. NONLINEAR DIAL MARKINGS

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- (a) Friction - Maximum Speed Pointer
- (b) Position Error - Maximum Speed Pointer
- (c) Hysteresis
- (d) After Effect Test
- (e) Maximum Allowable Speed Scale Error at Room Temperature
- (f) Low Temperature Operation
- (g) High Temperature Operation
- (h) Vibration Error
- (i) Maximum Pointer Stop
- (j) Low Temperature Exposure
- (k) High Temperature Exposure
- (l) Vibration Failure
- (m) Internal Inspection

3 6.1 Reliability program - The contractor shall establish a reliability program in accordance with MIL-STD-785.

3 6.2 Reliability in mean-time-between-failures - The indicator shall have 2,000 hours of mean (operating) time between failures when tested and accepted as outlined under the requirements of 4.4.3.

3.7 Markings -

3 7.1 Case connections - The back of the case as shown on MS28048 shall be marked with the letter "P" for the pressure connection, with the word "STATIC" printed twice, forming a ring around the static connection, and with the words "Mach Number Adjustment" for the Mach number adjustment access fitting. The following shall also be marked on the back of the case:

CAUTION: USE STRAIGHT THREAD FITTINGS ONLY.
DO NOT BLOW IN TUBES.

3 7.2 Dial - The size, material, or finish of the dial marking shall conform to the requirements specified in Figure 1 for MS28048-1 and -3 indicators and Figure 2 for MS28048-2 and -4 indicators.

3 7.2 1 Window - The window in the main dial showing the Mach number setting shall be large enough so that not less than two numerals on the subdial shall be visible at any time.

3 7.3 Visibility of dial markings - All graduations, numerals, pointer, and other markings on the dial shall be readable from any point within the frustum of a cone, the side of which makes an angle of not less than 30 degrees with a perpendicular to the dial and the small diameter of which is the aperture of the dial.

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3 7. 4. Nameplate - The nameplate, as specified in MIL-I-5415, shall be marked with the following information:

INDICATOR, INDICATED AIRSPEED; PITOT-STATIC,
 MAXIMUM ALLOWABLE SPEED, 50-650 KNOTS
 MS28048- (add proper dash number)
 Manufacturer's Name or Trade-Mark and Supply Code
 Manufacturer's Part No.
 Manufacturer's Serial No.
 Contract or Order No.
 U S Property

* 4 QUALITY ASSURANCE PROVISIONS

* 4. 1 Responsibility for inspection - Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified, the supplier may utilize his own facilities or any commercial laboratory acceptable to the Government. The Government reserves the right to perform any of the inspections set forth in the specifications where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

* 4. 2 Classification of inspection - Inspection of the indicator shall be classified as follows:

- (a) Qualification inspection: Qualification inspection consists of examinations and tests performed on sample indicators submitted for approval as a qualified product.
- (b) Quality conformance inspection: Quality conformance inspection consists of examinations and tests performed on indicators manufactured and submitted for acceptance under contract.

* 4. 3 Qualification inspection - The qualification inspection of the indicators shall consist of all of the examinations and tests of this specification performed in the order specified under the paragraph headed Inspection methods and shall include the Reliability Qualification Phase tests

* 4. 3. 1 Qualification inspection sample - Qualification inspection samples shall consist of three indicators manufactured in accordance with this specification. The indicators submitted for qualification inspection shall have been previously subjected only to the individual inspections. The samples shall be forwarded at the contractor's expense, to the laboratory designated in the Letter of Authorization.

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- * 4.3.1.1 Qualification inspection sample identification - The qualification inspection samples shall be plainly identified by durable tags, securely attached, and marked with the following information:

Sample for Qualification Inspection
 INDICATOR, INDICATED AIRSPEED; PITOT-STATIC, MAXIMUM
 ALLOWABLE SPEED, 50-650 KNOTS
 Submitted by (Manufacturer's name, date)
 for Qualification Inspection in accordance
 with Specification MIL-I-5419 under authorization
(reference letter authorizing tests).

- * 4.4 Quality conformance inspection - The Quality conformance inspection shall consist of the Individual inspection, the Sampling plans, and the Reliability assurance tests of this specification. The contractor shall furnish all samples and shall be responsible for accomplishing all the inspections. Sampling plan B inspections shall be conducted at a Government laboratory designated by the procuring activity. Quality conformance inspection, except for Sampling plan B, shall be under the supervision of the Government quality control representative. The contractor shall furnish test reports showing quantitative results for all tests required by this specification, signed by an authorized representative of the contractor or laboratory as applicable. Acceptance or approval of material during the course of manufacture shall in no case be construed as a guarantee of the acceptance of the finished product.

4.4.1 Individual inspection - Each indicator submitted for acceptance shall be subjected to the Individual inspection. This inspection shall determine compliance with the requirements of material, workmanship, operational adequacy, and reliability. As a minimum, each indicator accepted shall have passed the following inspections:

Examination of Product
 Leakage
 Scale Error (Room Temperature)
 Friction Error
 Friction Maximum Speed Pointer
 Position Error
 Position Error Maximum Speed Pointer
 Hysteresis
 After Effect
 Maximum Allowable Speed Scale Error at Room Temperature

4.4.2 Sampling plans - The Sampling plans shall consist of Sampling plan A and Sampling plan B inspections. The inspection samples selected for sampling tests shall have first passed the Individual inspections. The inspection samples which have been subjected to Sampling plan A inspection shall not be de-

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livered on contract until they have been refurbished and resubmitted and passed all the Individual inspections. Inspection samples which have been subjected to the Sampling plan B inspection shall not be delivered on contract.

- * 4.4.2.1 Sampling plan A sample selection- Sampling plan A samples shall be selected at random in accordance with the following schedule:

<u>Quantity Offered for Acceptance</u>	<u>Quantity to be Selected for Inspection</u>
First 15	(See Note)
Next 50	1
Next 75	1
Next 100	1
Each additional 200 or fraction thereof	1

NOTE: When Sampling plan B is invoked, the quantity shall be zero. When Sampling plan B is to be omitted, the quantity shall be one.

When a defective indicator occurs, no items from those still on hand or later produced shall be accepted until the extent and cause of failure have been determined and appropriately corrected. In addition, when a failure occurs, shift to one sample out of fifteen (when Sampling plan B is omitted) and proceed as indicated.

- * 4.4.2.1.1 Sampling plan A inspection - Each sample selected for Sampling plan A inspection shall be subjected to the following tests in the order listed:

Damping
Weight
Magnetic Effect
Pointer Zero Position Error
Low Temperature Operation
High Temperature Operation
Vibration Error
Overpressure
Maximum Pointer Stop

- * 4.4.2.2 Sampling plan B instructions - Two indicators shall be selected at random from the first 15 produced on contract and submitted within 10 days after manufacture. These samples shall be forwarded, at the contractor's expense, to a Government laboratory designated by the procuring activity. Each sample shall be plainly identified by a durable tag, securely attached and marked with the following information:

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INDICATOR, INDICATED AIRSPEED; PITOT-STATIC,
MAXIMUM ALLOWABLE SPEED, 50-650 KNOTS

Submitted by (Manufacturer's name, date)
for Production Acceptance Sampling Plan B
inspection, in accordance with MIL-I-5419 and
Contract/order No. _____
Manufacturer's part number _____

4.4.2.2.1 Sampling plan B approval - Approval of sampling plan B indicators shall be by the procuring activity upon satisfactory completion of the designated tests. Any design, material or performance defect made evident during this test shall be corrected by the contractor to the satisfaction of the procuring activity. Failure of the sample units to pass any of the tests shall be cause for deliveries of equipment under the contract to cease until proper corrective action is approved and accomplished.

4.4.2.2.2 Sampling plan B inspection - Each indicator selected for Sampling plan B inspection shall be subjected to the following tests, conducted in the order listed:

Sampling Plan A tests
Low temperature exposure
High temperature exposure
Vibration failure
Acceleration
Humidity
Seasoning
Fungus resistance
Salt spray
Aging
Mounting lug
Internal inspection

4.4.3 Reliability assurance tests shall be conducted under MIL-STD-781 for the Qualification Phase and the Sampling Phase Tests using Test Level E, except as specified herein. Each indicator selected for reliability assurance tests shall pass the Individual Tests before demonstrating an acceptable MTBF of 2000 hours. A performance log shall be maintained and readily available.

4.4.3.1 Reliability qualification phase - Prior to the acceptance of indicators under the contract or order, between 3 and 6 indicators shall be tested as outlined in MIL-STD-781 under the section entitled "Qualification Phase of Production Reliability Tests" using Test Plan III, except as specified herein.

4.4.3.2 Reliability sampling phase tests - The indicator samples shall be tested as outlined in MIL-STD-781 under the section entitled "Sampling Phase of Production Reliability Tests" using Test Plan V, except as specified herein.

- * 4.4.3.2.1 Lot size for sampling phase - All indicators offered for acceptance during each 3 month period (with the exception of those indicators used in the Qualification Phase) shall be considered as one lot. This test program shall start the first month after the Qualification Phase tests have been successfully completed. The test results shall be summarized monthly for the procuring activity. The procuring activity reserves the right to stop acceptance of indicators at any time after one or more reject decisions have been reached, pending a review of the contractor's efforts to improve the indicator, parts and quality control.
- * 4.4.3.3 Duty cycle of Test Level E of MIL-STD-781 shall consist of 2 hours at the low temperature in addition to the 2 hours at the high temperature. During each hour of duty cycling, the indicator airspeed reading shall be changed from 50 knots to 650 knots and returned to 50 knots within 5 minutes at a rate of 10 exercise cycles per hour.
- * 4.4.3.3.1 Performance characteristics to be measured - After every 200 hours of duty cycling, each indicator shall meet the Individual Tests, the Scale Error (-55° C) test and the Friction test. Upon completion of the Reliability Qualification Phase or the Reliability Sampling Phase tests, each indicator tested shall meet all the tests under Inspection Methods except that the humidity, fungus, salt spray and mounting lug tests need not be repeated.
- * 4.4.3.3.2 No preventive maintenance shall be performed on the indicators during the Reliability Tests.
- 4.4.3.3.3 Disposition of samples upon completion of tests - Any sample tested, other than those tested under the Reliability Qualification Phase, may be delivered on contract provided it is representative of production indicators currently being accepted, and it is in "good as new" condition or has been refurbished.
- * 4.5 Inspection conditions -
- * 4.5.1 Standard conditions - Unless otherwise specified, all inspections required by this specification shall be made under the following conditions:

Temperature
Pressure

Room ambient 25 ±5° C.
Normal atmospheric (approximately 29.92 inches Hg). When tests are made with atmospheric pressure substantially different from the above values, proper allowance for change in indicator reading shall be made for the difference from the specified conditions.

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Humidity

Room ambient 40 to 90 percent relative humidity.

4.5.2 Test readings - Unless otherwise specified, before a test reading is taken, the indicator shall either be tapped lightly or shall be vibrated using a vibrator set at 60 cps with a maximum double amplitude of 0.002 inch.

4.5.3 Attitude - Unless otherwise specified, the indicator shall be tested in its normal operating position.

4.5.4 Maximum speed pointer stop - The maximum speed pointer stop shall be so adjusted that the maximum speed pointer will not be stopped until it reaches the 650-knot reading.

4.6 Inspection methods - The indicator shall satisfy the performance requirements specified in Section 4 of MIL-5415, and as modified herein.

4.6.1 Leakage -

4.6.1.1 Case leak - The indicator shall be subjected to the "Case Leak" test as specified in MIL-I-5415, except it shall not be subjected to the pressure of 10 inches of mercury.

4.6.1.2 Diaphragm capsule leak - This test shall be performed in accordance with MIL-I-5415 using the airspeed pointer only.

* 4.6.2 Friction-maximum speed pointer - The indicator shall be tested for friction at every other one of the points marked with an asterisk in Table III beginning with the first asterisk. The pressure shall be decreased to bring the pointer to the desired reading and held constant while the two readings are taken, the first before the indicator is tapped, and the second, after the indicator is tapped. The difference between any two readings shall not exceed the values specified in Table I. The pointer shall move smoothly while the pressure is varied uniformly without vibration of the indicator. This test may be combined with the test for scale errors.

* 4.6.3 Position error - maximum speed pointer - The maximum speed pointer reading, taken while the instrument is held in any desired position and while it is being tapped, shall not differ from its reading, when held in any other position, by more than the amount specified in Table I. This test shall be made at every other one of the points of the scale indicated by an asterisk in Table III beginning with the first asterisk.

4.6.4 Hysteresis - Not more than 15 minutes after the indicator has been subjected to the pressure corresponding to the highest altitude specified in Table III, the pressure shall be increased at a rate corresponding to a decrease in altitude of approximately 3,000 feet per minute until the pressure corresponding to 30,000 feet is reached. The indicator shall remain at this pressure for at least

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TABLE I
TEST VALUES

Tests	Tolerance ± (Values in knots unless otherwise specified)
DAMPING Time required from full scale deflection to 60 knots	1.0 $\begin{smallmatrix} +.5 \\ -.2 \end{smallmatrix}$ second
AGING	3.0
FRICTION Maximum Speed Pointer Airspeed Pointer	3.0 3.0
POSITION ERROR Maximum Speed Pointer Airspeed Pointer	3.0 3.0
POINTER ZERO POSITION Indication at 0	1/16 inch
OVERPRESSURE Pitot pressure connection; 30 inches of mercury Static pressure connection; 6.0 inches of water Test altitudes 0 and 20,000 feet Test differential pressure equivalent to 100 and 400 knots	2.0
SEASONING	2.0

5 minutes, but not more than 15 minutes before the test reading is taken. After the reading has been taken, the pressure shall be further increased at the above rate until the pressure corresponding to 10,000 feet is reached. The indicator shall remain at this pressure for at least 1 minute, but not more than 10 minutes before a test reading is taken. After the reading has been taken, the pressure shall be further increased at the above rate until atmospheric pressure is reached. The reading of the maximum speed pointer at either of the two test points shall not differ from the corresponding reading, with decreasing pressure, by more than 2 knots.

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TABLE II
SCALE ERRORS AT ROOM TEMPERATURE

Speed Knots	Pressure Inches of Water ^{1/}	Allowable Scale Errors (Knots)	Speed Knots	Pressure Inches of Mercury	Allowable Scale Errors (Knots)
50 *	1.632	4.0	250	3.100	3.0
60	2.352	4.0	260 *	3.363	3.0
70	3.203	3.0	270 *	3.637	3.0
80 *	4.188	2.0	280	3.924	3.0
90	5.305	2.0	290	4.223	3.0
100 *	6.557	2.0	300	4.534	4.0
110	7.943	2.0	310	4.858	4.0
120 *	9.465	2.0	320	5.195	4.0
130	11.123	2.0	330	5.545	4.0
140	12.922	2.0	340 *	5.909	4.0
150 *	14.858	2.5	350	6.286	4.0
160	16.935	2.5	360	6.677	4.0
170	19.154	2.5	370	7.082	4.0
180 *	21.517	2.5	380 *	7.502	4.0
190	24.025	2.5	390	7.936	4.0
200	26.679	3.0	400	8.385	5.0
210	29.483	3.0	410	8.850	5.0
220 *	32.436	3.0	420 *	9.330	5.0
230	35.543	3.0	430	9.826	5.0
240	38.804	3.0	440	10.338	5.0
250	42.222	3.0	450	10.868	5.0
			460 *	11.414	5.0
			470	11.977	5.0
			480	12.558	5.0
			490	13.158	5.0
			500 *	13.776	5.0
			510	14.413	5.0
			520	15.069	5.0
			530	15.745	5.0
			540 *	16.442	5.0
			550	17.159	5.0
			560	17.898	5.0
			570	18.658	5.0
			580 *	19.441	5.0
			590	20.246	5.0
			600	21.075	5.0
			610	21.928	5.0
			620 *	22.805	5.0
			630	23.707	5.0
			640	24.635	5.0
			650 *	25.589	5.0

* Test Points

^{1/} Water Pressure referenced to 20° C.

TABLE III
 MAXIMUM ALLOWABLE SPEED SCALE ERRORS AT ROOM TEMPERATURE

Altitude 1000 Feet	MACH NUMBER											
	.6		.7		.8		.9		1.0		Allowable Scale Errors Knots	
	Airspeed Knots	Allowable Scale Errors Knots	Airspeed Knots	Allowable Scale Errors Knots	Airspeed Knots	Allowable Scale Errors Knots	Airspeed Knots	Allowable Scale Errors Knots	Airspeed Knots	Allowable Scale Errors Knots		
0	397*	4	463*	6	529*	8	595*	10	—	10	10	
5	364	4	426	5	488	6	550	8	613*	8	10	
10	333*	4	390*	4	446*	6	507*	6	566*	6	8	
15	303	4	356	4	410	5	464	6	520	6	8	
20	275*	4	323*	4	373*	4	423*	5	475*	5	6	
25	248	4	292	4	337	4	384	4	431	4	5	
30	223*	4	262*	4	303*	4	346*	4	390*	4	4	
35	199	4	235	4	272	4	310	4	350	4	4	
40	177*	4	209*	4	242*	4	277*	4	312*	4	4	
45	157*	4	186	4	216	4	247	4	279	4	4	
50	140	4	165*	4	192*	4	220*	4	248*	4	4	

* Test Points

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4.6.5 After effect test - Not less than 1 minute and not more than 5 minutes after the completion of the "Maximum Allowable Speed Scale Error at Room Temperature" and "Hysteresis" tests, the maximum speed pointer shall have returned to its original reading, corrected for any change in atmospheric pressure, to within 4 knots.

4.6.6 Maximum allowable speed scale error at room temperature - The maximum allowable speed pointer shall be tested for scale errors at the points of the scale indicated by asterisks in Table III. The test shall be accomplished by adjusting the Mach number adjustment to each of the settings listed at the top of Table III. During this test the pitot and static connection shall be connected together to a standard mercury barometer and to sources of vacuum and pressure. The reduction in pressure, as indicated by the barometer shall be made at a rate corresponding to an increase in altitude of approximately 3,000 feet per minute. The indicator shall remain at the pressure corresponding to each test point for at least 1/2 minute but not more than 5 minutes before a test reading is taken. The scale errors shall not exceed the allowable scale errors specified in Table III. This test shall be combined at each Mach number setting with the "Hysteresis" test.

4.6.7 Low temperature operation - The indicator shall be subjected to a temperature of $-55 \pm 2^\circ \text{C}$ for a period of 4 hours. At the end of this period and while still at this temperature, the indicator shall be tested for scale error as specified in the "Scale Error at Room Temperature" test and "Maximum Allowable Speed Scale Errors at Room Temperature" test (omitting that part of this test pertaining to Hysteresis) except that the test points shall be every other point in Tables II and III marked with an asterisk, beginning with the first asterisk. The total allowable scale errors shall not exceed the allowable scale errors specified in Tables II and III by more than 2 knots but in no case shall the total allowable scale error exceed 10 knots. During and after this test, the maximum speed pointer stop adjustment shall operate properly.

4.6.8 High temperature operation - The indicator shall be placed within a chamber and maintained at a temperature of $70 \pm 2^\circ \text{C}$ for a period of 4 hours. At the end of this period and while still at this temperature, the indicator shall be tested for scale errors as specified in the "Scale Error at Room Temperature" test and "Maximum Allowable Speed Scale Errors at Room Temperature" test (omitting that part of this test pertaining to Hysteresis) except that the test points shall be every other point in Tables II and III marked with an asterisk, beginning with the first asterisk. The total allowable scale errors shall not exceed the allowable scale errors specified in Tables II and III by more than 2 knots but in no case shall the total allowable scale error exceed 10 knots. During and after this test, the maximum speed pointer stop adjustment shall operate properly.

4.6.9 Vibration error - The indicator shall be mounted on a vibration stand with a line joining the centers of the two lower mounting holes in a horizontal plane, with the plane of the mounting lugs of the indicator vertical. This test shall

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be conducted at a Mach setting of 0.8, a pressure altitude of zero feet and differential pressure equivalent to 100 knots applied to the indicator. The indicator shall be subjected to a vibration with a circle diameter between 0.003 and 0.005 of an inch at frequencies from 500 to 3,000 cycles per minute to determine that the natural frequency of the indicator does not occur in this frequency range. While the indicator is being vibrated, the maximum total spread of pointer vibration and the pointer variation from its original position shall not exceed 2 knots for either pointer. This test shall be repeated with a pressure altitude of 20,000 feet and a differential pressure equivalent to 400 knots, and the same value for pointer variation shall apply.

4.6.10 Maximum pointer stop - The indicator shall be disconnected from external sources of vacuum or pressure. The stop mechanism shall be tested for the range by turning the maximum pointer adjustment screw to determine the limits of adjustment. The pointer adjustment shall operate smoothly throughout the range of at least 300 to 650 knots on the airspeed scale. No damage or loosening in the mechanism shall result from this test.

4.6.11 Low temperature exposure - The indicator shall be subjected to the low temperature exposure test specified in MIL-I-5415. At the end of the 24-hour period and while still at the low temperature, the indicator shall be tested for scale errors as specified in the "Scale Error at Room Temperature" test and "Maximum Allowable Speed Scale Errors at Room Temperature" test (omitting that part of this test pertaining to Hysteresis), except that the test points shall be every other point in Table II and III marked with an asterisk, beginning with the first asterisk. The total allowable scale errors shall not exceed the allowable scale errors specified in Tables II and III by more than 2 knots, but in no case shall the total allowable scale error exceed 10 knots. During and after this test, the maximum speed pointer stop adjustment shall operate properly.

4.6.12 High temperature exposure - The indicator shall be subjected to the high temperature exposure test specified in MIL-I-5415. After the indicator has returned to room temperature, it shall be tested for scale errors as specified in the "Scale Error at Room Temperature" test and "Maximum Allowable Speed Scale Errors at Room Temperature" test (omitting the part of this test pertaining to Hysteresis), except that the test points shall be every other point in Tables II and III marked with an asterisk, beginning with the first asterisk. The total allowable scale errors shall not exceed the allowable scale errors specified in Tables II and III by more than 2 knots, but in no case shall the total allowable scale error exceed 10 knots. During and after this test, the maximum speed pointer stop adjustment shall operate properly.

4.6.13 Vibration failure - This test shall be conducted at a Mach number setting of 0.8. The instrument shall be subjected to a pressure altitude of 20,000 feet and a differential pressure equivalent to 400 knots, and the readings of both pointers shall be noted. The indicator shall be subjected to a vibration with a circle diameter between 0.018 and 0.020 of an inch for a 1-hour period at a frequency of 1,000 cycles per minute, and followed by a 1-hour period at a frequency of 2,000

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cycles per minute and then followed by a 1-hour period at a frequency of 3,000 cycles per minute. At the end of the vibration period the indicator shall again be subjected to the pressure specified above and the pointer indications noted. The change in reading of either pointer shall not exceed 2 knots. No looseness in the mechanism or damage to any part of the indicator shall result from this test.

- * 4.6.14 Internal inspection - The case of the indicator shall be opened and the internal mechanism examined. Any deterioration or damage which could in any manner prevent the indicator from meeting functional operation or maintenance requirements during service life shall be cause for rejection.

5. PREPARATION FOR DELIVERY

5.1 The packaging, packing and marking requirements for this indicator shall be as specified in Section 5 of MIL-I-5415.

6. NOTES

6.1 Intended use - The airspeed indicators covered by this specification are intended for use to indicate airspeed and to indicate the maximum allowable airspeed at any altitude.

6.2 General - The instructions contained in Section 6 of MIL-I-5415 are applicable to and shall form a part of this specification.

- * 6.3 Qualification - With respect to products requiring qualification, awards will be made only for such products as have, prior to the time set for the opening of bids, been tested and approved for inclusion in the applicable Qualified Products List whether or not such products have actually been so listed by that date. The attention of the suppliers is called to this requirement and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government, tested for qualification, in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. The activity responsible for the Qualified Products List is the Naval Air Systems Command, Department of the Navy, Washington, D. C. 20360, and information pertaining to qualification of products may be obtained from that activity. A copy of the request for information should be forwarded to the Commanding General, Wright Air Development Center, Wright-Patterson Air Force Base, Ohio 45433.

6.4 Precedence of documents - When the requirements of the contract, this specification, or applicable subsidiary specification are in conflict, the following precedence shall apply:

- (a) Contract - The contract shall have precedence over any specification.

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- (b) This specification - This specification shall have precedence over all applicable subsidiary specifications. Any deviation from this specification, or from subsidiary specifications where applicable, shall be specifically approved in writing by the procuring activity.
- (c) Referenced specifications - Any referenced specification shall have precedence over all applicable subsidiary specifications referenced therein. All referenced specifications shall apply to the extent specified.

* 6.5 Asterisk - In specification revisions and superseding amendments an asterisk "*" preceding a paragraph number denotes paragraphs in which changes have been made from the previous issue. This has been done as a convenience only and the government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content as written, irrespective of the asterisk notations and relationship to the last previous issue.

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Navy - AS
Air Force - 71

Preparing activity:

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INSTRUCTIONS		
This sheet is to be filled out by personnel either Government or contractor, involved in the use of the specification in procurement of products for ultimate use by the Department of Defense. This sheet is provided for obtaining information on the use of this specification which will insure that suitable products can be procured with a minimum amount of delay and at the least cost. Comments and the return of this form will be appreciated. Fold on lines on reverse side, staple in corner, and send to preparing activity (as indicated on reverse hereof).		
SPECIFICATION MIL-I-5419B INDICATOR, INDICATED AIRSPEED; PITOT-STATIC, MAXIMUM ALLOWABLE SPEED, 50-650 KNOTS		
ORGANIZATION (Of submitter)		CITY AND STATE
CONTRACT NO	QUANTITY OF ITEMS PROCURED	DOLLAR AMOUNT
MATERIAL PROCURED UNDER A		
<input type="checkbox"/> DIRECT GOVERNMENT CONTRACT <input type="checkbox"/> SUBCONTRACT		
1 HAS ANY PART OF THE SPECIFICATION CREATED PROBLEMS OR REQUIRED INTERPRETATION IN PROCUREMENT USE? A GIVE PARAGRAPH NUMBER AND WORDING		
B RECOMMENDATIONS FOR CORRECTING THE DEFICIENCIES		
2 COMMENTS ON ANY SPECIFICATION REQUIREMENT CONSIDERED TOO RIGID		
3 IS THE SPECIFICATION RESTRICTIVE? <input type="checkbox"/> YES <input type="checkbox"/> NO IF "YES" IN WHAT WAY?		
4 REMARKS (Attach any pertinent data which may be of use in improving this specification. If there are additional papers, attach to form and place both in an envelope addressed to preparing activity)		
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